



Code No. : **298**

**FACULTY OF SCIENCE**  
**M.Sc. I Semester Examination, November/December 2012**  
**PHYSICS/APPLIED ELECTRONICS**  
**Paper – I : Mathematical Physics**

Time: 3 Hours]

[Max. Marks: 80

***N.B. : Answer all questions in Part – A and Part – B. Each question in Part – A carries 4 marks and in Part – B carries 12 marks.***

**PART – A**

**(8×4=32 Marks)**

1. Obtain Legendre polynomial  $P_4(x)$ .
2. Show that Bessel's function of the first kind,  $J_{-n}(x) = (-1)^n J_n(x)$ .
3. Prove the recurrence relation  $H_n(-x) = (-1)^n H_n(x)$  for hermite polynomials.
4. Mention the importance of Laplace equation and express it in spherical co-ordinate system.
5. Find the fourier sine transform of  $f(x) = x^2; 0 < x < 4$ .
6. Find the Laplace transform of  $g(t) = e^{3t} + \cos(6t) - e^{3t} \cos(6t)$ .
7. State and prove the associative law of matrix multiplication.
8. Explain contravariant, co-variant and mixed tensors with examples.

**PART – B**

**(4×12=48 Marks)**

9. a) Write Legendre's differential equation and find its solution by power series method. Where do they appear in physics problems ?

OR

- b) i) Obtain generating function for Bessel's function of the first kind.  
ii) Discuss orthogonality of Bessel's function of first kind.



10. a) i) Derive Rodrigue's formula for Hermite polynomials.  
ii) Obtain Hermite polynomial,  $H_4(x)$ .

OR

- b) i) Solve the hypergeometric equation

$$x(1-x) \frac{d^2 y}{dx^2} + [c - (a+b+1)x] \frac{dy}{dx} - aby = 0 \text{ about } x = 0.$$

- ii) Show that Legendre polynomials are particular case of hyper geometric function.

11. a) i) What is the Fourier transform of a function ? Discuss the modulation and convolution properties of Fourier transform.

- ii) Find the Fourier transform of  $f(t) = \frac{\sin at}{t}$ ;  $a > 0$ .

OR

- b) What is the Laplace transform of a function ? Show that the Laplace transform of  $\frac{\cos at}{t}$  does not exist.

12. a) i) What is inverse of a matrix ? How do you find the inverse of a matrix ?  
ii) Find the inverse matrix of the following matrix :

$$\begin{bmatrix} 1 & -1 & 3 \\ -1 & 1 & 2 \\ 3 & 2 & -1 \end{bmatrix}$$

OR

- b) i) What is a tensor ? Distinguish between symmetric and anti symmetric tensors.  
ii) State and prove quotient law of tensors.
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